REPORT

OF

THE EXPERT COMMITTEE ON ENERGY SAVING IN THE FIRING BRICKS IN HIGH DRAUGHT KILN DEVELOPED BY CBRI

GOVERNMENT OF INDIA
NATIONAL BUILDINGS ORGANISATION
MINISTRY OF URBAN DEVELOPMENT
NIRMAN BHAWAN, NEW DELHI-110011

PREFACE

An Expert Committee was set up in 1982 by the then Ministry of Works & Housing under the Convenorship of Director, National Buildings Organisation to carry out an indepth study of the High Draught kiln developed by CBRI. The Committee was also to consider and suggest steps for preservation of agricultural land by adoption of alternative technology for brick kilns.

The Experts Committee, after an indepth study and visits to number of High Draught kilns and traditional bull's trench kilns and discussions, came to the conclusion that savings in the consumption of coal to the extent of 25 per cent was possible by adoption of High Draught kilns for burning of bricks. The Committee has also recommended various incentives to encourage the brick manufacturers for setting up High Draught kilns or converting the traditional bulls trench kiln by installing a fixed chimney which also saves 10 to 15 per cent of fuel.

The Committee has also recommended that surveys of suitable soils other than agricultural lands should be carried out to earmark clay deposits for brick making.

The report of the Expert Committee is being printed for wide circulation and to promote the setting up of efficient brick kilns which would save considerable amount of fuel. It is hoped that brick manufacturers will come forward to adopt such modern kilns with the technical advice of NBO and CBRI.

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Director
National Buildings Organisation

86-MJ(N)195NBO—1

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CHAPTER I

INTRODUCTION

0.1 About 40,000 million bricks are produced annually by over 20,000 small brick manufacturing units spread out all over the country. It is estimated that over 7.0 million tonnes of coal is consumed per year by the brick industry. National Buildings Organisation (NBO) has been promoting various techniques for improving the quality and increasing the production of bricks with particular attention to energy saving. One technique considered by NBO is the High Draught (H.D.) kiln developed by Central Building Research Institute (CBRI), Roorkee, for burning of bricks which is expected to save considerable quantity of coal and burn bricks better, resulting in a reduction of energy conrumption. At a meeting held on 7th June, 1982 under the Chairmanship of Shri M. K. Mukharji, Secretary, Ministry of Works & Housing, which was attended by the representatives of CBRI, Ministry of Energy (Department of Coal), Railways, HUDCO and NBO the H.D. kiln developed by CBRI was considered and it was felt that it was necessary that an independent assessment of the performance of the H.D. kiln should be made by an Expert Committee, which would carry out indepth study in the working of the kiln to find out the actual saving in the consumption of coal. In pursuance of this decision, an Expert Committee under the convenorship of Shri G.C. Mathur Director, NBO was formed by the Ministry of Works and Housing vide Ministry's Memorandum No. N-21015/16/82-HI dated the 24th June, 1982 (Annexure I) with the following terms of reference :

(1) To carry out an indepth study of the High Draught kiln developed by the CBRI to find out :—

  (a) The amount of actual saving in the consumption of coal by adoption of High Draught kiln as compared to the burning of bricks by the Bulls Trench kiln.

  (b) Requirement of skilled manpower for operating the kiln.

  (c) Investment required for setting up such a kiln.

(2) To evaluate the requirement of electrical energy and the performance of the plant run by the diesel engines as a primary source or as an alternative source in the event of power shut downs.

(3) To recommend suitable incentives to encourage the brick manufacturers for setting up High Draught kiln for burning bricks.

(4) To consider and suggest steps for preservation of agricultural lands by adoption of alternative technology for brick kilns.

0.2 Shri C.V. Nair, Superintending Engineer, DCC III, Central P.W.D. was also included as a member of the Expert Committee as per Office Memorandum No. N-21015/16/82-HI dated the 30th June, 1982 Ministry of Works & Housing (Annexure II).

0.3 Another important issue, in which came up in the meeting chaired by the Secretary, Ministry of Works & Housing mentioned above, is the problem of large scale conversion of agricultural land due to brick manufacturing activity. Subsequently on the note prepared by N.B.O. the Miniitry of Works & Housing through their U.O. No. N. 121015/16/82-HI, dated 8-7-1982 asked the expert group also to consider the matter regarding wastage of precious soil most suited for agriculture in the manufacture of bricks (Annexure III).

1.0 The Expert Committee held four meetings, on 2nd July, 1982 at Ahmedabad, 6th July, 1982 at Pathonkot, 30th July, 1982 and 16th August, 1982 at Delhi. The representatives of the All India Brick and Tile Manufacturers Federation were invited to participate in the discussions held on the third and fourth meetings.

1.1 Since the operation of brick kilns stop before the onset of rainy season. visits were arranged to H.D. kilns set up in the country at a very short notice, *i.e.* before the middle of July, 1982. The Expert Group visited the H.D. kilns installed at Ahmedabad by a private firm M/s. Raj Clay Products, on 2nd July, 1982.

1.2 The Expert Committee also visited two H.D. kilns set up in the public sector by the Thein Dam Circle Authorities at Pathankot on 6th July, 1982. Some of the members of the Committee also visited fixed brick chimney installed in the traditional bulls trench kiln by Bhtrat Brick Supply Co. at village Manwal near Pathankot on 7th July, 1982. Information on High Draught kiln supplied by Thein Dam Township Circle, Pathankot, is given at Annexure V.

1.3 On the 16th of August, 1982, the Expert Committee made a visit to Sat Bari Village near Chattarpur, Delhi where a number of brick kilns were existing about a decade ago and the lands available, after the clay has been utilised for brick making, have now been reclaimed and now put to agricultural use again. A visit to fixed brick chimney erected in the traditional bulls trench kiln at Kishangarh, Mehrauli Village Delhi was also made.

1.4 The study carried out by the Expet Committee and the conclusions arrived at are given in Chapter II and III. The last chapter contains recommendations of the Expert Committee.

1.5 The Committee wishes to regad its deep appreciation of the help rendered by the Officers of the National Buildings Organisation, particularly Dr. A.V.R. Rao and Shri J. Sen Gupta and his colleagues. The Committee is also grateful to the authorities inchirge of the Raj Clay Products and Thein Dam Authorities and all India Brick & Tile Manufacturers Federation, who organised the visits to H.D. kilns and fixed-brick-chimney kilns and assisted in the deliberations of the Committee. The Committee expresses gratefulness to the various Organisation who had nominated the experts no the Committee and also the co-operation nf the number for attending the meetings and visits at a very short notice.

1.6 The Committee trusts that promotional measures suggested by it would receive earnest attention by all those concerned and it would not only be possible to establish new H.D. kilns but also improve the traditional bulls trench kiln for saving of energy in brick burning and also effecting improvement in the quality of bricks.

CHAPTER II

INDEPTH STUDY OF THE HIGH DRAUGHT KILN DEVELOPED BY THE CENTRAL BUILDING RESEARCH INSTITUTE, ROORKEE

2.0 A High Draught kiln has been developed by the Central Building Research Institute to ensure better burning of bricks and reducing the coal consumption. It is an archless, top-fed, coal-fired continuous kiln in which the fire follows a *zig-zag* path. The setting area is divided into a number of chambers by partition walls. The partition walls are built with unfired bricks and dismantled at the time of unloading the bricks from the chamber. About 7,500 bricks can be loaded in each chamber and a daily output of 15,000 bricks can be secured. Similar kilns of enlarged dimensions can be designed for burning upto 30,000 bricks per day. Draught is provided by 15 H. P. fan and the products of combustion are channelised through a system of flues, the flow of gases being controlled by suitable dampers.

2.1 The Expert Committee carried out an indepth study of the H.D. kiln on the basis of information supplied by CBRI. The Expert Committee also examined the working of H.D. kiln installed by M/S Raj Clay Products at Ahmedabad in the private sector and by Thein Dam Town Circle at Pathankot and held detailed discussions regarding efficiency of H.D. kiln and the extent of savings in coal. During the third and fourth meetings held at Delhi, the Committee also had detailed discussions with the members of the All India Brick and Tile Manufacturers Federation about the energy saving in the firing of bricks by H.D. kiln. As a result of the study, the following conclusions were arrived on various terms of reference.

2.2 *Amount of Actual Saving in the Consumption of Coal in H.D. kilns as compared to Bulls Trench kiln*—The amount of coal consumed in the traditional bulls trench kiln depends upon various factors such as the characteristics of the clay used for brick making, the calorific value of the coal used and the amount of ash content in the coal, the regularity of the feeding and skill and experience of the firemen, who operate the kiln. Therefore, the coal consumption varies from place to place in the traditional bulls trench kilns, which are more than 20,000 in numbers and scattered all over the country. The coal consumption varies from 13 tonnes per lakh of bricks in Gujarat to 32 tonnes per lakh of bricks in West Bengal. A considerable saving can be achieved in the bulls trench kilns by adopting proper firing methods. It has come to the notice of the Committee that there has been considerable improvements made in the traditional brick kilns during the past decade such as installation of fixed brick chimney, which has resulted in the saving of consumption of coal to the extent of 10 to 15 per cent. The All India Brick and Tile Manufacturers Federation has reported that 150 fixed brick chimney known as "Beant Chimney" have been erected in the bulls trench kilns during the last four to five years and are operating satisfactorily.

2.2.1 The quality of coal used is a very important factor which influences the consumption of coal for brick burning. When slack coal of grade B having calorific value of about 5.000 calories/Kg is used, the consumption of coal in the traditioanl bulls trench kiln in Gujarat was about 13 tonnes per lakh of bricks whereas the coal consumption of inferior quality having an ash content as high as 40 per cent (which is being supplied to the brick industry), shoots up 16 to 18 tonnes per lakh of bricks. In the case of H.D. kilns, the inferior quality coal, Grade F, cannot be used as it will adversly affect the burning operaton. It is necessary that only good quality coal be used in the case of H.D. kiln.

2.2.2 The electrical energy required to run the 15 H.P. fan and to operate the Jaw Crusher for reducing the size of coal for weeding to the kiln is 7.33 Kwh per 1,000 bricks. The cost of electrical energy consumed by the fan has been reported by Thein Dam authorities as Rs. 4.40 per 1,000 bricks. The coal required to generate this amount of electrical energy worked out 570 kg./lakh of bricks (Annexure VI). The committee has also noted that no electrical energy is consumed in the operation of traditional brick kilns as well as the fixed brick chimney kilns.

2.2.3 Taking into consideration all the improvements made in traditional kilns, the Committee is of the opinion that installation of H.D. kiln still would result in considerable saving in the consumption of coal, even over the fixed brick chimney bulls trench kiln. The saving of coal would be about 5 tonnes per lakh of bricks which is about 25 per cent of the consumption of fuel in the traditional bulls trench kilns. As compared to fixed brick chimney the coal savings would be of the order of 3 tonnes/lakh of bricks or 15 per cent. The Committee noted that installation of H.D. kiln has following added advantages:

(a) 90 per cent of the bricks produced are first class as compared to 65—70 per cent in traditional kilns and

(b) less pollution is created due to better combustion in H.D. kiln.

2.3 *Requirement of Skilled Manpower*—The Expert Committee came to the conclusion that there is not much difference in the requirement of additional skilled labour for operating the HD kiln except that the services of a part-time skilled worker—Mechanic/Electrician—is required for running as well as maintenance of the H.D. fan and maintenance of the valves and dampers.

2.4 *Investment Required for Setting up H.D. kilns*—The investment required for setting up a H.D. kiln of capacity of 30,000 bricks per day is of the order of Rs. 2.5 lakh which includes a diesel generating set for operating the H.D. kiln during the power shut-downs. An additional investment of about Rs. 2.0 lakh is required if a shed is provided over the kiln. Provision of shed to cover the kiln is considered optional. The H.D. kiln without covered shed can operate only six to seven months in the year as in the case of traditional bulls trench kilns. It may be mentioned that the H.D. kilns installed at Ahmedabad and Pathankot, which were visited by the Expert Committe, were covered with sheds and therefore were operating for longer period than the bulls trench kilns. The investment required for setting up a traditional bulls trench kiln of same capacity, *i.e.,* 30,000 bricks per day is Rs. 40,000 and with a fixed brick chimney is Rs. 1.0 lakh (Rs. 60,000 for the chimney).

2.5 *Requirement of Diesel Generator*—The burning operation of H.D. kiln is a continuous one and the H.D. kiln as well traditional bulls trench kiln operate round the clock. A 15 HP motor is installed with the kiln which runs continously for providing draught to the kiln. In addition to the H.D. fan, electrical energy is also required to operate the Jaw Crusher used for crushing lumps of coal to smaller size. Since the burning is a continuous operation, power shedding will adversly affect the burning operation. An un-interrupted supply of power for the kiln is a must. The H.D kilns intalled at Ahmedabad and Pathankot, which were visited by the Expert

Committee were fortunate enough to have uninterrupted supply of power. But such situations are rare and at most of the places shutdowns are quite common. As it is not possible to have uninterrupted supply of power, a diesel generating set as a stand-by is necessary. Such a generating set would cost about Rs. 60,000. The Committee therefore, recommends installation of diesel set as a must and therefore is included in the investment required for establishing a H.D. kiln. Alternatively a high speed diesel engine could also be used. The cost of generating one unit of electricity by diesel set has been worked out by Shri S.P. Jain, Director, CEA, member of the Committee and is given at Annexure VI. The information supplied on H.D. kiln installed at Ahmedabad by M/S Raj Clay Products is at Annexure IV and the information supplied on the H.D. kiln by Thein Dam Authorities at Pathakotn is at Annexure V.

CHAPTER III

INCENTIVES TO ENCOURAGE BRICK MANUFACTURERS FOR SETTING UP H.D. KILNS AND STEPS FOR PRESERVATION OF AGRICULTURAL LAND BY ADOPTION OF ALTERNATIVE TECHNOLOGY FOR BRICK KILNS.

3.1 *Incentive to Encourage Brick Manufacturers*—The Committee came to the conclusion that considerable savings in the consumption of coal, to the extent of 25 per cent is possible by adoption of H.D. kilns for the burning of bricks (Chapter II). The Committee considered various suggestion put forth by the members particularly from the members from Housing & Urban Development Corporation and Department of Energy and Coal, to provide incentives to encourage the brick manufacturers for setting up H.D. kilns for burning of bricks or converting the traditional bulls trench kiln, by setting up a fixed brick chimney which also saves 10 to 15 per cent of fuel for burning of bricks. The All India Brick and Tile Manufacturers Federation pleaded that further research and development work has to be undertaken by the CBRI and NBO for further improving the efficiency of the fixed brick chimney since it could easily be installed in the existing bulls trench kilns with an extra investment of Rs. 60,000, whereas H.D. kilns could be established only when new kilns for brick production are installed. The following incentives were considered by the Committee to encourage setting up H.D. kilns as well as the fixed brick chimney kilns.

(1) In view of the increase in energy efficiency in the system of firing of burnt bricks in the H.D. kiln and fixed brick chimney kilns, higher rate of depreciation to the extent of 30 per cent may be permitted.

(2) The financial institutons/corporations like HUDCO should be advised for providing financial assistance in the form of loans on easy terms, subsidies and other tax concessions for setting up H.D. kilns and accept the fixed assets as mortgage for financing instead of a bank guarantee.

(3) The training for kiln operators to run the H.D. kiln and traditional kiln may be arranged by organisations like NBO and CBRI as operation of kilns by trained kiln operators would result in a considerable saving of fuel.

(4) The State Governments and other institutions should allocate adequate areas of non-agricultural land for installation of H.D. kilns for manufacture of bricks on long term basis.

(5) Since there are considerable savings in the consumption of coal by adopting H.D. kiln, priority should be given for following good quality coal (at least 4,000 K. cal/Kg to brick units who install H.D. kilns as without good quality of coal these kilns cannot operate.

(6) Movement of coal by rail for users of H.D. kilns should be considered in the similar category as for the mechanised brick plants.

(7) The construction agencies like Central P.W.D., State Housing Boards, Development Authorities as well as other construction agencies who are consumers of large quantity of bricks should encourage/install HD Kilns to meet their requirements.

(8) It was also considered that the licensing of the H.D. kilns is a cumbersome process. The institutions who are involved *e.g.* NRDC and CBRI should charge only nominal fee for providing the technical know-how to encourage the setting up of such type of plants in the country.

3.2 *Steps for Preservation of Agricultural Land by adoption of Alternative Technology for Brick Making*

3.2.1 The Committee noted that the question of preservation of agricultural land by adoption of alternative technology for brick kilns has been engaging attention of researchers in India for quite some time. Investigations have been undertaken in different types of soils, particularly those that are not suitable for agriculture, such as saline soils, river silts, sediments collected in river banks and tanks, *etc.* A note prepared by CBRI on this subject which is given in Annexure VII, was considered by the Committee. The work done by CBRI and other such laboratories in this regard should be taken advantage of by setting up pilot demonstration kilns to determine the practical feasibility of producing good quality bricks from non-agricultural soils and assessing the commercial viability of such a process as well.

3.2.2 The Committee noted that in some places, particularly in Calcutta, the silt from river and water tanks was being utilised for brick making. It also noted that attempts have been made in some places to use soils which are available at depths greater than 1.5 metres for brick making, by resorting to mechanisation of the process of brick making. This is one alternative approach for preserving agricultural land as has been done extensively in western countries. However, over half-a-dozen mechanised brick plants which have been set up in the country including the one at New Delhi set up by NBCC, have not provided to be economically viable as heavy investment is required for mechanisation. The Committee is of the view that the extent to which mechanisation can be taken advantage of, for conserving agricultural land for brick making should be further studied.

3.2.3. The Committee is of the opinion that survey of suitable soils other than agricultural soils should be carried out on priority basis in order to locate and earmark clay deposits for brick making. The CBRI, NBO and Directorate General of Small Scale Industries should take up the work and sufficient funds should be allocated for this project.

3.3 *Reclaiming of the Land Used for Bricks Marking*

3.3.1 Generally speaking the soils which are fine grained and plastic are also suitable for making good quality bricks. As such brick fields have been using agricultural soils to a large extent. In the vicinity of metropolitan cities and towns, a large number of brick kilns have cropped up in the wake of large demands for bricks for a variety of construction activities. For instance, in the vicinity of Delhi there are at present some 250 brick kilns operating and is understood that during the last 2-3 years some 100 new brick kilns have been set up to cope with the increased demand. It has been found that at many places only 1 to 1.5 m deep soil is allowed to be excavated for brick production. However at some places, depending upon the topography of the soil, suitable soils are available at greater depths. When the lands are given on lease by the Government for operating brick kilns or private lands are allowed to be used for this purpose there is no stipulation by the local administration, granting loans or licence for brick making, that after the operations are over, the land shall be uniformly levelled so as not to permit collection of rain water, which would act as cess pool, *etc*. However, in Delhi it was observed that some old brick fields had been levelled up and used for agricultural purposes. It was mentioned that earlier, when the brick making operations were undertaken, these fields had not been put to intensive agricultural uses. The Committee could consider this problem only to a limited extent and visited lands which used for brick making in the villages Satpari and

Krishangunj in Delhi, where most of the land have been reclaimed and is being used for intensive agriculture.

3.3.2. As regards land occupied by brick fields in the vicinity of metropolitan centres and large cities, on account of great pressure on land, the old brick fields have been reclaimed and utilised for extension of the city for housing and construction purposes. As the land values have appreciated considerably, land occupied by brick kilns have been reclaimed. As more and more land has been required for extension of urban areas, large tracts of agricultural soil including old brick fields are being utilised for housing and construction activities. In the light of this and appreciation in land values, utilisation of agrcultural land by brick fields happens to be a part of the larger problem of conservation of agricultural soils in the wake of fast pace of urbanisation.

3.3.3 As brick making operations are scattered all over the country and there are more than over 20,000 brick kilns consuming mostly local agricultural soils, the question of conservation of agricultural land needs to be studied in greater depths in consultation with agricultural and soil experts, urban planners, environmentalists, *etc.* As the Committee had to submit its report in a short time of two months, it had not been possible for it to consult various concerned and to provide specific guidelines on these.

3.3.4 The Committee, however, was of the view that by proper coordination, it should be possible to utilise land used by brick fields for agricultural purposes, as well as for growing farm ponds, water channels, *etc.*, depending upon the situations. In any case, in order that old brick fields do not lead to cess pools of waste water, which creates environmental hazards, the local administration must adopt appropriate measures and also stipulate suitable conditions in this regard while granting lease or licence for setting up new brick fields. The Committee was of the view that conservation of agricultural soil is a matter of great significance and the extent to which brick making operations adversely affect need to be given careful attention. It suggested that this matter may be examined further in consultation with the concerned specialists.

3.3.5. In view of the above the Committee felt that it is the responsibility of the concerned authority to make available land to brick manufacturers and to make it obligatory for the brick manufacturers to leave the land properly levelled and providing by levelling it and proper drainage arrangements to avoid water logging.

CHAPTER IV

RECOMMENDATIONS

The following recommendations have emerged finally from the delibrations of the Expert Committee on the High Draught kiln :

Reference Item 1

To carry out indepth study of the High Draught kiln developed by CBRI to find out :

(a) The amount of actual saving in the consumption of coal by adoption of High Draught kiln as compared to the burning of bricks by the bulls trench kiln;

(b) Requirement of skilled man power for operating the kiln; and

(c) Investment requirement for setting up of such a kiln.

I Considerable saving in the consumption of coal to the extent of 25 per cent could be achieved by adoption of H. D. kiln as compared to the traditional bulls trench kiln. Wherever feasible, all the new kilns which are to be set up if future should be H.D. kilns.

(Action by All India Brick & Tile Manufacturers Federation, CPWD, DDA, State Housing Boards and P.W.Ds. etc).

II. The adoption of fixed brick chimney (Beant Chimney) in the traditional bulls trench kiln would also result in the saving of consumption of coal to the extent of 10 per cent as compared to traditional bulls trench kiln. Fixed brick chimney should be installed in the traditional bulls strench kilns, wherever feasible.

(Action by the Brick Industry).

III. Training Courses for the technicians, kiln operators of the H.D. kilns/fixed brick chimney kilns should be organised by CBRI and NBO periodically.

(Action by CBRI, NBO, All India Brick & Tile Manufacturers Federation, etc.)

IV. Good quality grade-D slack coal having minimum of calorific value 4,000 Kilo Calorie per Kg. and having high volatile matter and low-ash content should be made available on priority basis to the brick manufacturers who install H D. kilns.

(Action by the Department of Coal, Ministry of Energy, Ministry of Railways and State Governments).

V. Similar facilities should also be given to the brick manufacturers, who install fixed chimneys in their kilns.

(Action by Department of Coal, Ministry of Energy, Ministry of Railways and State Governments).

VI. The CBRI should undertake research and development work on priority basis for improving the efficiency of fixed brick chimneys.

(Action by CBRI, All India Brick & Tile Manufacturers Federation.)

VII. An investment of the order of Rs 2.5 lakh is required to install a H.D. kiln. The shed over the kiln is required if the kiln is to run throughout the year continuously. The Committee considered that providing a kiln shed is optional. The financial institutions should provide the investment required and the working capital to the extent of 100 per cent.

(Actio by DUDCO, Banks, *etc.*)

VIII. An investment of about Rs. 1.00 lakh is required for installing fixed brick chimney which includes of Rs. 40,000 as cost of the traditional bulls trench kiln. As in the case of H. D. kilns, similar assistance should be extended for installing fixed brick chimneys.

(Action by HUDCO, BANKS, *etc.*

Reference Item 2 :

To evaluate the requirement of electrical energy and the performance of the plant run by the diesel engine as a primary source or as an alternative source in the event of power shut down.

IX. H. D. kilns oprate continuouly round the clock and therefore the electrical energy required for 15 HP induced draft fan should be supplied without any interruption, wherever it is feasible.

(Action by the State Electricity Boards and Director of Industries).

X. Uninterrupted supply of power is a must for operating the H.D. kiln, Instalation of a 20 KVA Diesel Engine/generator as a stand by is necessary in the event of power shedding.

(Action by the Brick Manufacturers/Entrepreneurs).

Reference Item 3

To recommend suitable incentives to encourage the brick manufacturers for settling up H.D. kiln for burning of bricks.

XI. Financial Institutions, Corporation like the HUDCO should provide financial assistance in the form of loans on easy terms, subsidies and other incentives for setting up of H. D. kilns/ fixed brick chimneys and accept the fixed assets as mortgage for financing instead of asking for bank guarantees.

(Action by the Ministry of Works & Housing, HUDCO, Banks, *etc.*).

XII. A higher rate of depreciation to the extent of 30 per cent may be permitted in the case of H.D. kilns since the installtion of H.D. kilns will result in less pollution and considerable saving of energy.

(Action by the Ministry of Finance, Ministry of Energy,, Mnistry of Works & Housing, *etc.*).

XIII. Movement of coal by railways for operation of H.D. kilns should be considered in the similar category as for the machanised brick plants.

(Action by the Ministry of Railways).

XIV. The State Governments and other institutions should allocate adequate non-agricultural land, for installition of H.D. kilns for the manufacture of bricks, on long-term basis.

(Action by the State Governments).

XV. The institutions which are involved in the licencing of H.D. kilns such as NRDC and CBRI should liberalise the procedures of licensing and only charge a nominal fee for providing the technical know-how to encourage setting up such types of kilns. The CBRI should have adequate staff for providing technical guidance and assistance to the entrepreneurs.

(Action by the CBRI and NRDC).

Reference Item 4

To consider and suggest steps for preservation of agricultural lands by adoption of alternative technology for brick kilns.

XVI. The survey of suitable soils other than agricultural lands should be carried out to earmark clay deposits for brick marking.

(Action by CBRI, Director General of SSI, NBO and State Governments).

XVII. Investigations carried out by the CBRI for utilisation of soils other than agricultural soils for brick making such as saline soils use of river silts, marine clays, should be demonstrated by setting up pilot demonstration project to establish the efficacy of the process developed. Further investigations required in this field should be undertaken by the CBRI on priority basis.

(Action by CBRI, NBO).

Reference Item 5

Reclaimation of land used for brick making.

XVII. The authorities who make available land for brick manufacture should make it obligatory for the brick manufacturers to leave the land properly levelled and providing drainage arrangements are made to avoid water logging.

GENERAL RECOMMENDATIONS

XIX. The Construction Agencies like CPWD, Housing Boards, Development Authorities as well as other Construction Departments who are consumers of large quantity of bricks should encourage/install H.D. kilns to meet their requirements of bricks.

(Action by Construction Agencies).

XX. Demonstration-cum-Training Centres should be set up in major brick producing areas in the country to demonstrate the advantages of installing H. D. kilns and to train the insermen and kiln operators.

(Action by NBO, CBRI, Ministry of Works & Housing).

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Convenor
Sd/-
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Member
Sd/-
(S. D. Jain)
Member

ANNEXURE I

GOVERNMENT OF INDIA
MINISTRY OF WORKS & HOUSING

. . . .

No. N-21015/16/82-*HI.* *New Delhi, the 24th June,* 1982.

SUBJECT : Energy saving in the firing of bricks in High Draught kiln developed by the C.B.R.I.

The Central Building Research Institute, Roorkee has developed a High Draught kiln for burning of bricks which is expected to save considerable quantities of coal and better burning of bricks resulting in reduction of consumption of energy. At a meeting held under the Chairmanship of Shri M.K. Mukharji, Secretary, Ministry of Works and Housing, which was attended by the representatives of CBRI, Ministry of Energy (Department of Coal), Railways, HUDCO and NBO, it was felt necessary that an independent assessment of the performance of high draught kiln should be made by an Expert Committee, which would carry out an in-depth study of the working of the high draught kiln to find out the actual saving in the consumption of coal.

2. In pursuance of the decision, an Expert Committee consisting of the following is hereby constituted :—

1. Shri G.C. Mathur	Director, National Buildings Organisation—Convenor.
2. Shri N.C. Majumdar . . .	Scientist, C.B.R.I. Roorkee—Member.
3. Shri S.P. Jain	Director, C.E.A. Department of Power, Ministry of Energy—Member.

4. Shri S.D. Jain	Additional Director, Railway Board, Ministry of Railways—Member.
5. Shri A.K. Goyal	Department of Coal, Ministry of Energy—Member
4. Shri H.K. Yadav	Chief (Projects), Housing & Urban Development Corporation, (HUDCO) or representative from the HUDCO—Member.

3. The terms of reference of the Committee shall be as follows :

(1) To carry out an in-depth study of the High Draught kiln developed by the C.B.R.I. to find out:

  (*a*) The amount of actual saving in the consumption of coal by adoption of High Draught kiln as compared to the burning of bricks by the Bulls Trench kiln.

  (*b*) Requirement of skilled manpower for operating the kiln.

  (*c*) Investment required for setting up such a kiln.

(2) To evaluate the requirement of electrical energy and the performance of the plant run by the diesel engines as a primary source or as an alternative source in the event of power shut downs.

(3) To recommend suitable incentives to encourage the brick manufactures for setting up High Draught kiln for burning of bricks.

(4) To consider and suggest steps for preservation of agricultural lands by adoption of alternative technology for brick kilns.

4. The Committee may visist couple of plants where High Draught kilns are installed and running. The T.A. and D.A. for such visits and attending the meetings will be met by the respective departments.

5. The Committee will complete the study and submit its report within a period of two months from the date of issue of this Office Memorandum.

sd/—
(M.K. MOITRA)
Director (Housing)

ANNEXURE II

No. N-21015/16/82-*HI*

GOVERNMENT OF INDIA
MINISTRY OF WORKS & HOUSING
(NIRMAN AUR AWAS MANTRALAYA)

New Delhi, dated the 30*th June*, 1982.

OFFICE MEMORANDUM

SUBJECT : Energy Saving in the Firing of Bricks in High Draught Kiln developed by C.B.R.I.

Reference this Ministry's memorandum of even number dated 24-6-82 consistuting an Expert Committee to study the above subject.

2. In partial modification of paragraph 2 of the above mentioned memorandum it has been since decided that Shri C.V. Nair, Superintending Engineer, DCC III, CPWD shall also be a member of the Expert Committee.

sd/-
(M.K. MOITRA)
Director (*Housing*)

ANNEXURE III

GOVERNMENT OF INDIA
MINISTRY OF WORKS & HOUSING
(HOUSING SECTION)

SUBJECT : Energy Saving in firing of bricks in the C.B.R.I. High Draught Kiln.

Director, National Buildings Organisation may please refer to his note dated the 16th June, 1982 sent to Secretary regarding wastage of precious soil most suited for agriculture in the manufactures of bricks,

2. The group set up on high draught kilns may consider this point, in addition.

sd/-

Under Secretary to the Govt. of India,

Director ; National Buildings Organisation

Min. of W&H/U.O. No. N-21015/16/82-HI, dated 8-7-1982.

ANNEXURE-IV

INFORMATION ON HIGH DRAUGHT KILN SUPPLIED BY M/s. RAJ CLAY PRODUCT—AHMEDABAD

1.	Capacity of the kiln	30,000 bricks per day.
2.	Total investment required for setting up the kiln (July '82) including shed and ID fan.	Rs. 3,87,000 approx.
3.	Coal consumption in H.D. kilns for one lakh bricks	
	(*a*) with good quality slack coal	10—11 MT
	(*b*) with inferior quality slack coal	13—15 MT
4.	Coal consumption in Bulls trench kiln per lakh of bricks in Gujarat (average)	16—18 MT
5.	Type of coal used	Good quality slack coal
6.	Total productivity during :—	
	1. 1979	29 lakhs
	2. 1980	49 lakhs
	3. 1981	51 lakhs
7.	Cost of labour employed for firing and operating the kiln	Rs. 7,000 per month (approx.)
8.	Cost of electrical power for operating the fan for producing induced draught	Rs. 2.70 per 1000 bricks
9.	Horse power of the fan	15 HP
10.	Quality of bricks produced from the kiln	
	(*a*) First class	90%
	(*b*) Second class	10%

ANNEXURE V

INFORMATION ON HIGH DRAUGHT KILN SUPPLIED BY THEIN DAM TOWNSHIP CIRCLE, PATHANKOT

1.	Investment required for setting up on H. D. Kiln (without brick making machine and drying sheds)	Rs. 3.5 lakh.
2.	Installed capacity of the kiln	75 lakhs bricks per annum.
3.	Size of Kiln	34.14 m x 18.90 m (112 ft. x 62 ft).
4.	Size of sheds	8 Nos; each 36.58 m x 11.19 m (120 ft. x 60 ft.)
5.	Coal consumption for firing 1 lakh bricks	14 MT
6.	Economy in fuel consumption vis-a-vis trench kiln at Pathankot	8 MT. of slack coal saved per lakh of bricks fired.
7.	Type of coal used	Grade-C---Slack coal from Jharia.
8,	Average production per month per kiln.	6 lakh bricks.
9.	Actual output per day	22,000 bricks.
10.	Production during last 2-1/2 years	140 lakh bricks.
11.	Average quality of coal consumed	1960 MT.
2,	Burning temp.	800°C—1000°C

सत्यमेव जयते

13.	Total No. of chambers	24.
14.	Capacity of each chamber	15,000 bricks.
15.	Time taken for firing one round	15 days in summer. 17-18 days in winter/rains.
16.	No. of rounds per year	22.
17.	No. of chambers used for cooling	12.
18.	No. of chamber used for loading & unloading	2.
19.	No. of chambers fired/day	2.
20.	No. of bricks burnt/round	3.5 lakh.
21.	Repair/replacement of dampers	Every 30 months.
22.	Horse power of the fan	15 H.P.
23.	Horse power of the crusher	7.5 H.P.
24.	Exhaust capacity of the fan	414.5 Cum per minute (15,000 cft./mt.).
25.	Cost of operation of the fan for production of Induced draught.	Rs. 4.40 per 1000 bricks.
26.	Use of diesel engine	Nil.
27.	Requirement of labour for firing operation	Foreman . . . 1 Firemen . . . 6 Coalmen (Beldars) . . . 3 Loaders . . . 5 Unloaders . . 7 Electrician . . 1

28. Cost of firing (without coal) per 1000 nos. bricks	Rs. 7.73.
29. (*i*) Cost of coal @ Rs. 4.50/MT.	Rs. 13,600 per month.
(*ii*) (a) Cost of electricity	Rs. 4.40/1000[Electricity @ 0.60 per unit.
(b) cost of diesel	Rs. 0.24/1000 nos.
(*iii*) Depreciation and rent on the kiln	Rs. 11.51/1000 bricks.
(*iv*) Maintenance cost	
(*a*) feed pots	Rs. 1.85/1000 nos.
(*b*) Dampers	Rs. 1.25/1000 nos.
(*v*) Cost of loading and unloading	Loading—Rs. 9.91/1000 nos. Unloading—Rs. 14.40/1000 nos.
30. Average strength of machine moulded bricks	367.7 kg/cm^2.
31. Average strength of hand moulded bricks	186.20 kg./cm^2.
32. Average percentage water absorption of machine moulded bricks	8%.
33. Average percentage water absorption of hand moulded bricks	14%

ANNEXURE VI

REQUIREMENT OF ELECTRICAL ENERGY FOR RUNNING THE FAN FOR HIGH DRAUGHT KILN AT THEIN DAM

(*a*) *Based on Coal*

1.	Horsepower of the fan	15 H.P.		
2.	Cost of electrical energy per thousand bricks	Rs. 4.40		
3.	Cost of one unit	Re. 0.60		
4.	No. of units consumed per thousand bricks	$\frac{4.40}{0.60}$	=	7.33
5.	No. of units consumed per lakh bricks in running the fan	$\frac{7.33 \times 100,000}{1000}$	=	733 KW
6.	Assuming transmission and distribution losses @ 20% the total number of units required.	$\frac{733 \times 120}{100}$	=	878 KW
7.	Assuming 8% loss in auxiliaries, units to be generated.	$\frac{878 \times 108}{100}$	=	950 KW
8.	Calorific value of coal	4000 K Cal/Kg.		
9.	Consumption of coal for each KW generated	0.6 Kg.		

10. Total consumption of coal for generating 950 units . . 950 x 0.6—570 Kg.

(b) Based on Diesel Oil

1. Rated capacity of the fan . . . . 15 H.P.

2. Electrical units consumed by the fan in one day (24 hrs.) . $\frac{15 \times 746 \times 24}{1000} = 268.5$ KW

3. Capacity of the diesel set required for running the fan . . 20 KVA

4. Requirement of diesel oil for generating electricity per day . 72 litres

5. Average production of bricks per day 22,000

6. Requirement of diesel oil per lakh of bricks . . . $\frac{72 \times 100,000}{22,000} = 327$ litres

Cost of electricity generated

7. Assuming the capital cost of diesel set as Rs. 60,000 and the cost of diesel oil @ Rs. 2.85 per litre, the cost of generation one unit of electricity . . . . Rs. 1.50

ANNEXURE VII

Extracts from C.B.R.I. Buildings Materials Note No. 13 *on Bricks from Saline* (*Kallar*) *Soils*

Introduction—Saline and alkali soils, popularly called 'Kallar' in Punjab, 'Reh', 'Ussar' and 'Kalrathi' in Uttar Pradesh, Bihar *etc.*, are generally considered unsuitable for agricultural purposes. These soils are formed as a result of accumulation of soluble salts such as chlorides and sulphates of calcium, magnesium and sodium, and carbonates and bicarbonates of sodium and postassium. Saline soils contain soluble salts upto 0.2 percent and have hydrogen in concentration of 8.2 to 8.5, the conductivity of the saturation extract is 4 m mhos/cm at 25°C. Exchangeable sodium of such soils is less than 15 percent. Water availalbe in such regions is brackish and saline.

Saline soils are considered unsuitable for the manufacture of bricks. They exist in large tracts of alluvium overlying Punjab, Haryana, Uttar Pradesh and Bihar. Bricks manufactured from such soils show heavy efflorescense and scum. They crumble on weathering and loose strength during the course of time. The surface of the wall gets disfigured and plaster peels off. These bricks when used in reinforced structures cause corrosion in reinforcement.

As a result of investigations conducted at the Central Building Research Institute, a process has been developed to manufacture good quality building bricks from saline soils. Large scale manufacture of bricks from saline (Kallar) Soils of Haryana has been sucessfully demonstrated to the industry. This note briefly describes the process.

Soil Characteristics—Kallar soils of Haryana and Punjab, mostly alluvium, contain Illitic and Kaolintic groups of clay minerals. These soils are sticky and hard and contain total fines in the range of 40 to 55 percent and clay 16 to 20 percent.

The general characteristics of these soils are :

Soluble salts	0.2 to 0.5 percent
Hydrogen concentration	8.2 to 8.5

Exchangeable cations	Calcium and Sodium
Exchangeable sodium	Less than 15 percent

The soluble salts in these soils exist mostly as chlorides and sulphates of sodium, calcium and magnesium. At depths below 1.3 metres, hard clay particles or deposit of kankar (Calcium Carbonate) nodules occur.

Water available in these soil belts is saline containing total solids up to 1.50 per cent, mostly as chlorides, sulphates and carbonates of sodium, magnesium and calcium.

Clay Preparation—The plastic Kallar soils obtained from different depths are mixed manually and spread to make a platform of volume 4.3-5.7 cu m and size 3.0m × 3.0m × 0.5 to 0.6 metre. It is filled with 0.5 percent common salt (sodium chloride) solution on dry weight (kg) basis of the soil *i.e.*, common salt dissolved in 500 litre of water per 5.7 cu. m of soil. The dilution of the slat solution is further adjusted so that the prepared clay mass containes water slightly above its plastic consistency. There to four per cent coal ash, (0.3 to 0.34 cu. m coal ash per 5.7 cu.m of soil) on the dry weight basis of the soil is sprinkled manually in the layers of the wet soil. The carbon content in the coal ash should be less than 15 percent. The whole admixture is left overnight and the clay mass is then manually kneaded to make it homogneous and plastic enough for moulding bricks. The plastic clay mass is left for 24 hours for ageing.

Moulding and Firing—The processed soil is used for the hand-moulding of bricks either by slop method or by table-moulding. The moulded bricks are dried under the sun, which takes about four to six days during summer and 10 to 12 days during winter. The dried bricks are set in Bull's kiln for firing, adopting conventional pattern of setting and a firing temperature of 1020°C to 1040°C with a soaking period of minimum three to four hours.

Field Manufacture—About 1.5 lakh bricks were moulded and fired in a Bull's Kiln at Kharkhoda (Rohtak) by the process described. During burning of these bricks in summer, the coal consumption was found to be 12 to 13 Tonnes per lakh compared to 14 Tonnes per lakh for burning normal bricks. The production of first class bricks is increased by 8 to 10 per cent. The results of field production of bricks are given in table 1.

TABLE 1—*Field Production of Grade Bricks*

Classification	Experimental Bricks %	Control Bricks %
Ist Class	79	70
IInd Class	12	120
IIIrd Class	3.5	5
Over burnt	5.5	5

TABLE 2—*Properties of Building Bricks Manufactured*

Properties	IST Class		IInd Class		I.S. Specification
	Experimental	Control	Experimental	Control	IS : 1077:1970
1. Crushing Strength (Kg/sq. cm)	100 to 212	87 to 159	37 to 80	35 to 54	50
2. Water Absorption(%)	10 to 11	11 to 13	16 to 23	16 to 23	20
3. Efflorescence	NIL	Moderate	Moderately heavy	Heavy	Moderate
4. Soluble Slat (%)	0.08 to 0.10	0.15 to 0.17	0.18 to 0.20	0.22 to 0.25	—

ANNEXURE VIII

LIST OF PERSONS WITH WHOM THE EXPERT COMMITTEE HELD DISCUSSIONS

1. Shri D. P. Chadha, Hony. Secretary, All India Brick and Tile Manufacturers Federation. (A.I.B.T.M.F.)
2. Shri M.L. Jain, President, —do—
3. Shri S.K. Sethi, Executive Secretary of A.I.B.T.M.F.
4. Shri K.G. Bapahna, Raj Clay Products Ahmedabad.
5. Shri P.U. Metha, Raj Clay Products, Ahmedabad.
6. Shri T.S. Nag, S.E. Thein Dam Township Circle, Pathankot.
7. Shri A.K. Aeri, E.E. Thein Dam Township Circle Pathankot.
8. Shri Harish Kapur, M/s Desraj Kapur & Sons (Fixed Brick Chimney Kilns), Delhi.

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